



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/824,701	04/14/2004	Jinshan Li	HSJ920040067US1	6802

44425 7590 11/28/2006

THOMAS R. BERTHOLD  
18938 CONGRESS JUNCTION COURT  
SARATOGA, CA 95070

EXAMINER

RENNER, CRAIG A

ART UNIT PAPER NUMBER

2627

DATE MAILED: 11/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/824,701

Applicant(s)

LI ET AL.

Examiner

Craig A. Renner

Art Unit

2627

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 and 18-23 is/are rejected.
- 7) ☒ Claim(s) 17 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 April 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. ____.                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>14 April 2004</u> .   | 6) <input type="checkbox"/> Other: ____.                          |

## **DETAILED ACTION**

### ***Drawings***

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include one or more reference signs mentioned in the description. Note, for instance "10" (disclosed as a "disk drive" in lines 1 and 2 of paragraph [0015] on page 4, for instance).

Corrected drawing sheets in compliance with 37 CFR 1.121(d) and/or an amendment to the specification in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, "wherein the pinned layer is an antiparallel-pinned layer" as set forth in claims 10 and 20 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) and/or an amendment to the claims in compliance with 37 CFR 1.121(c) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### ***Specification***

3. The disclosure is objected to because of the following informalities:
  - a. In line 12 of paragraph [0018] on page 5, "sense current  $I_S$ " should be changed to --sense current  $I_S$ -- in order to be consistent with the remainder of the disclosure.

b. In lines 14-15 of paragraph [0018] on page 5, "free-layer magnetization 110" should be changed to --free-layer magnetization 111-- in order to be consistent with the remainder of the disclosure.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a. Elements in the claims are indefinite because they lack clear and/or positive antecedent basis including "the layers" (line 2 of claim 1) and "the range of interest" (line 7 of claim 1).

b. Claims 2-12 inherit the indefiniteness associated with independent claim 1 and stand rejected as well.

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-4, 6-16 and 18-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Fukuzawa et al. (US 2002/0048127).

With respect to claims 1-4 and 6-12, Fukuzawa teaches a magnetoresistive sensor comprising a substrate (101); a pinned ferromagnetic layer (13) on the substrate and having an in-plane magnetization direction oriented in a first direction and prevented from substantial rotation in the presence of an external magnetic field in the range of interest (lines 2-4 in paragraph [0072] on page 5, for instance); a nonmagnetic electrically-conductive spacer layer (14) on the pinned layer; a free ferromagnetic layer (15) on the spacer layer and having an in-plane magnetization direction oriented substantially perpendicular to the first direction in the absence of an external magnetic field, the free layer magnetization direction being substantially free to rotate in the presence of an external magnetic field (lines 5-7 in paragraph [0072] on page 5, for instance); a first capping layer (17, for instance) on the free layer, the first capping layer comprising one or more oxides of Zn (lines 1-3 in paragraph [0256] on page 16, for instance); and a second capping layer (20 or 18, for instance) on the first capping layer, the second capping layer comprising an oxide of a metal having an oxygen-affinity greater than Zn (lines 1-2 in paragraph [0274] on page 17, for instance, i.e., alumina (aluminum oxide), for instance; or, alternatively, lines 1-10 in paragraph [0272] on page 17, for instance, i.e., yttrium oxide, chromium oxide, magnesium oxide, or manganese

oxide, for instance) [as per claim 1]; wherein the first capping layer comprises ZnO (lines 1-3 in paragraph [0256] on page 16, for instance) [as per claim 2]; wherein the second capping layer comprises one or more oxides selected from the group consisting of tantalum, aluminum, hafnium, zirconium, yttrium, titanium, tungsten, silicon, vanadium, magnesium, chromium, niobium, molybdenum and manganese (lines 1-2 in paragraph [0274] on page 17, for instance, i.e., alumina (aluminum oxide), for instance; or, alternatively, lines 1-10 in paragraph [0272] on page 17, for instance, i.e., yttrium oxide, chromium oxide, magnesium oxide, or manganese oxide, for instance) [as per claim 3]; wherein the second capping layer comprises one or more oxides of Ta (lines 1-6 in paragraph [0258] on page 16, for instance, i.e., oxidized Ta) [as per claim 4]; wherein the first capping layer has a thickness in the range of approximately 5Å to 40Å (lines 1-8 in paragraph [0278] on page 18, for instance) [as per claim 6]; wherein the second capping layer has a thickness in the range of approximately 10Å to 80Å (lines 1-8 in paragraph [0278] on page 18, for instance) [as per claim 7]; wherein the sensor further comprises an antiferromagnetic layer (12) on the substrate, the pinned ferromagnetic layer being exchange-coupled to the antiferromagnetic layer [as per claim 8]; wherein the sensor further comprises a seed layer (11) on the substrate, the antiferromagnetic layer being located on the seed layer [as per claim 9]; wherein the pinned layer is an antiparallel-pinned layer (lines 1-12 in paragraph [0265] on page 17, for instance, or lines 1-13 in paragraph [0281] on page 18, for instance, or lines 2-5 in paragraph [0295] on page 19, for instance) [as per claim 10]; wherein the free layer is formed of an alloy of one or more of Co, Fe and Ni (line 1 in paragraph [0179] on page

12, for instance, or line 6 in paragraph [0295] on page 19, for instance) [as per claim 11]; and wherein the free layer comprises a CoFe alloy (line 1 in paragraph [0179] on page 12, for instance, or line 6 in paragraph [0295] on page 19, for instance) [as per claim 12].

With respect to claims 13-16 and 18-23, Fukuzawa teaches a current-in-the-plane spin-valve magnetoresistive read head comprising a first read-head gap layer (102) of electrically insulating material; a layer of antiferromagnetic material (12) on the gap layer; a pinned ferromagnetic layer (13) exchange-coupled to the antiferromagnetic layer and having an in-plane magnetization direction oriented in a first direction and prevented from substantial rotation (lines 2-4 in paragraph [0072] on page 5, for instance) in the presence of a magnetic field from a magnetic recording medium (200); a nonmagnetic electrically-conductive spacer layer (14) on the pinned layer; a free ferromagnetic layer (15) on the spacer layer and having an in-plane magnetization direction oriented substantially perpendicular to the first direction in the absence of an external magnetic field, the free layer magnetization direction being substantially free to rotate in the presence of a magnetic field from the medium (lines 5-7 in paragraph [0072] on page 5, for instance); a first capping layer (17, for instance) on the free layer, the first capping layer comprising one or more oxides of Zn (lines 1-3 in paragraph [0256] on page 16, for instance); a second capping layer (20 or 18, for instance) on the first capping layer, the second capping layer comprising an oxide of a metal having an oxygen-affinity greater than Zn (lines 1-2 in paragraph [0274] on page 17, for instance, i.e., alumina (aluminum oxide), for instance; or, alternatively, lines 1-10 in paragraph



[0272] on page 17, for instance, i.e., yttrium oxide, chromium oxide, magnesium oxide, or manganese oxide, for instance); and a second read-head gap layer (105) of electrically insulating material on the second capping layer [as per claim 13]; wherein the first capping layer comprises ZnO (lines 1-3 in paragraph [0256] on page 16, for instance) [as per claim 14]; wherein the second capping layer comprises one or more oxides selected from the group consisting of tantalum, aluminum, hafnium, zirconium, yttrium, titanium, tungsten, silicon, vanadium, magnesium, chromium, niobium, molybdenum and manganese (lines 1-2 in paragraph [0274] on page 17, for instance, i.e., alumina (aluminum oxide), for instance; or, alternatively, lines 1-10 in paragraph [0272] on page 17, for instance, i.e., yttrium oxide, chromium oxide, magnesium oxide, or manganese oxide, for instance) [as per claim 15]; wherein the second capping layer comprises an oxide or oxides of Ta (lines 1-6 in paragraph [0258] on page 16, for instance, i.e., oxidized Ta) [as per claim 16]; wherein the first capping layer consists essentially of an oxide of Zn (lines 1-3 in paragraph [0256] on page 16, for instance) having a thickness in the range of approximately 5Å to 40Å (lines 1-8 in paragraph [0278] on page 18, for instance) and the second capping layer consists essentially of an oxide of Ta (lines 1-6 in paragraph [0258] on page 16, for instance, i.e., oxidized Ta) having a thickness in the range of approximately 10Å to 80Å (lines 1-8 in paragraph [0278] on page 18, for instance) [as per claim 18]; wherein the head further comprises a seed layer (11) on the first read-head gap layer, the antiferromagnetic layer being located on the seed layer [as per claim 19]; wherein the pinned layer is an antiparallel-pinned layer (lines 1-12 in paragraph [0265] on page 17, for instance, or lines 1-13 in

paragraph [0281] on page 18, for instance, or lines 2-5 in paragraph [0295] on page 19, for instance) [as per claim 20]; wherein the free layer is formed of an alloy of one or more of Co, Fe and Ni (line 1 in paragraph [0179] on page 12, for instance, or line 6 in paragraph [0295] on page 19, for instance) [as per claim 21]; wherein the free layer comprises a CoFe alloy (line 1 in paragraph [0179] on page 12, for instance, or line 6 in paragraph [0295] on page 19, for instance) [as per claim 22]; and wherein the head is a component of a magnetic recording disk drive (150) comprising a rotatable magnetic recording disk (200); an air-bearing slider (153) maintained near the surface of the disk and having an air-bearing surface facing the disk surface and a trailing surface substantially perpendicular to the air-bearing surface (as shown in FIG. 24(a), for instance); and the head located on the slider trailing surface (as shown in FIG. 24(a), for instance), the in-plane magnetization direction of the pinned layer being oriented substantially perpendicular to the disk surface (necessary for the current-in-the-plane spin-valve magnetoresistive read head to function) [as per claim 23].

***Claim Rejections/Considerations - 35 USC § 103***

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

***Pertinent Prior Art***

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. This includes Hayashi et al. (US 6,178,073), which teaches a magnetoresistive sensor with a capping layer including zinc oxide (lines 15-25 in column 7, for instance).

***Allowable Subject Matter***

10. Claim 17 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claim 5 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

***Conclusion***

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Craig A. Renner whose telephone number is (571) 272-7580. The examiner can normally be reached on Monday-Tuesday & Thursday-Friday 9:00 AM - 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hoa T. Nguyen can be reached on (571) 272-7579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2627

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Craig A. Renner  
Primary Examiner  
Art Unit 2627

CAR